LUPUS VULGARIS,

ITS TREATMENT BY CARBON ARC-LIGHT BATHS.

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Introduction.

BY the discovery of the therapeutic properties of ultra-violet light, vast possibilities in the treatment of all tubercular lesions have been opened up. Not the least important of these lesions is lupus vulgaris, which until now has, in many cases, obstinately defied cure. The ultra-violet light universal bath, while still in its childhood regarding experience of technique, etc., has already proved itself the greatest curative agent yet discovered for lupus vulgaris, producing dramatic results in many an old-standing case which has resisted every other method of treatment.

In this Thesis I shall endeavour to show the marvellous results of carbon arc-light baths in lupus vulgaris, and though the improvement may appear slow, we must allow for the amount of destruction of skin in the disease, and its many years' duration in most cases.

During the past fourteen months I have had the privilege of working in the Lupus Light Department of the/

the Edinburgh Royal Infirmary under Sir Norman Walker, who until recently was Physician for Diseases of the Skin in that hospital. I am greatly indebted to him for permission to use some of his cases for my Thesis. Altogether about fifty cases of lupus have been treated by the light baths during the past fourteen months, of which eighteen, picked at random, are described at the end of this Thesis.

I. Pathology of Lupus Vulgaris.

Sampson Handley(1) considers that lupus vulgaris is primarily a disease of the lymphatic system, the pathological condition present being a destructive lymphangitis of the lymphatic vessels of the skin, due to the presence and direct action of the Tubercle Bacillus in these vessels.

The lymphatic vessels take origin in the papillae of the skin as blind finger-like end-sacs lined by endothelium. This central lymphatic end- sac is surrounded by blood capillaries. About the junction of the superficial and middle thirds of the skin several of these lymphatic end-sacs join together to form lymphatic vessels, but there is no anastomotic lymphatic network extending parallel with the surface of the skin at this level. These lymphatic vessels are accompanied by an artery and vein, and dip down through the remainder of the skin, and through the subcutaneous fat to the deep fascia, where there is a lymphatic plexus into which they open. The deeper two-thirds of the skin are poor in lymphatic vessels. Thus the absence/

absence of any anastomotic communication of the superficial lymphatics, except by way of the fascial plexus, prevents the direct lymphatic spread of lupus along the skin. Extension of the disease can only occur by the pathological process first descending along the lymphatics to the fascial plexus, then extending laterally, and later reascending to the skin to invade adjoining primary lymphatic areas. Thus in the spread of lupus, according to Handley, we have punctate nodules appearing in the skin near the primary lesion. In this way the extension of the tubercular process in lupus vulgaris is similar in mode to the spread of carcinoma and melanotic sarcoma of the skin.

The disease then is, according to Handley, a tubercular lymphangitis from the beginning, affecting at first the dermal lymphatics, but later spreading to the subcutaneous lymphatics and to those of the deep fascia. The lymphatic vessels are destroyed and replaced by cords of tubercular granulation tissue, which compress the artery and vein accompanying the lymphatic vessel, causing at first, owing to compression of the vein, redness and swelling of the skin papillae, and later, when the artery is compressed, we have necrosis occurring, resulting in ulceration and caseous changes.

The/

The particular form of lupus is determined in this way by the degree of pressure on the blood vessels, depending on whether the artery or the vein is obliterated.

In support of the view that lupus is a destructive lymphangitis, Handley gives statistics of 122 cases of lupus carcinoma in only 16 of which the glands were involved, showing that the lymphatic channels had been previously destroyed or blocked. Sir John Bland Sutton also comments in one of the earlier editions of his book on "Tumours" upon the failure of lupus carcinoma to disseminate.

In support of Handley's lymphangitic theory we have the following facts -

1. the fact that lupus is nodular,
2. that it affects the superficial third of the dermis,
3. the discontinuous mode of spread, and,
4. the obstinately recurrent nature of the disease if only the superficial part of the skin is excised, although due to an aviru-lent form of the Tubercle Bacillus.

In those cases suitable for excision of the lupus patch, we must be guided in the operation by the anatomical/

anatomical arrangement of the lymphatic vessels of the skin. The affected area of skin must be removed down to, and including, the deep fascia, so one must cut down till muscular tissue is seen on the floor of the resulting wound. Also, as the disease spreads laterally in the deep fascia before it appears in the skin, the incision must extend at least one quarter of an inch external to the edge of the lupus patch.

Microscopical Appearances of Lupus Vulgaris.

The most typical feature of lupus vulgaris is the presence in the skin of the so-called "apple jelly nodules", about the size of a hemp seed, and each composed of ten or twelve round cellular clumps of a definite and characteristic microscopical appearance. These clumps appear as an accumulation of cells situated about the capillaries and lymph channels in the deeper portion of the corium, and are composed of a central mass of large epithelioid cells with clear nuclei, surrounded by an outer envelope of small round lymphoid-like cells. Amongst the large epithelioid cells we find an occasional giant cell with homogeneous centre and peripherally arranged nuclei, and very occasionally a tubercle bacillus is seen amongst the mass of cells. The number of tubercle bacilli present probably vary with/

with the acuteness of the case. The epithelioid cells are fewer in number and the giant cells in larger representation than is observed in the classical nodule of tuberculosis, and there is, moreover, more vascularity and a greater formation of connective tissue. (3)

Bowen(4) is of the opinion that the small round peripheral cells may have developed from the adventitia of the capillaries and lymph channels, and it is probable that these small cells are, in the main, the parents of the epithelioid and giant cell formations.

The next stage in the history of the lupus nodule is the degeneration of the newly formed cells and fibrillary tissue. The cells lying in the centre of the nodule are the first to be affected, their protoplasm becomes homogeneous, while the nuclei lose to a certain extent their susceptibility to staining. This degenerative process is due to the toxic influence of the tubercle bacillus, and, owing to the small numbers of the latter, it is a slow process.

Together with this degeneration in the epithelioid cells, there is also a regenerative process. The cells are capable of proliferation when not affected by the virus to the extent of advanced degeneration, and may/

may finally become converted into connective tissue, producing in this way the lupoid scar tissue. There may in some cases be excessive production of fibrous tissue with corresponding decrease in the number of tubercular nodules, resulting in the type known as Fibroid Lupus.

As the tuberculous infiltration of the corium increases in size, it gradually extends towards the surface of the skin, destroying the component elements by pressure, and may emerge on the surface, being only covered by the superficial epithelial layers.

Finally a rupture of this superficial epithelium may occur, pyogenic organisms which are present on the skin surface get in, leading to ulceration, purulent discharge and crust formation. Therefore in the formation of ulceration in lupus vulgaris we have a septic process superimposed upon the tuberculous process.

The pathology of the rarer forms of Tuberculosis Cutis, namely Lupus Miliaris Disseminatus Faciei, and the papulonecrotic tuberculids Folliclis and Acnitis, differs somewhat from true Lupus Vulgaris. All of these/

these conditions have been proved to be tubercular in etiology, as in each the tubercle bacillus has been demonstrated histologically in the lesions, successful animal inoculations have been done, positive focal and general tuberculin reactions have been recorded, successful therapy with tuberculin injection has been reported, and the Von Pirquet test is usually positive.

Lupus Miliaris Disseminatus Faciei.

This is relatively a benign bacillary tuberculosis of the skin. In it there are present rounded or oval papules, varying in size from a pinhead to bird-shot, either flattened or slightly elevated above the skin surface, and at first bright red in colour, but later brownish red. On pressing the papule with a pointed instrument, such as a tooth-pick, the soft consistence of lupus tissue is revealed.

Microscopical examination of these papules shows a structure very similar to that already described for lupus vulgaris, but usually there is present caseous degeneration, especially in the larger sized papules.

Folliclis/

Folliclis and Acnitis.

Folliclis and Acnitis are more or less similar manifestations of the same dermatosis. Folliclis is the more superficial form, and appears most frequently on the backs of the fingers and hands, palms, forearms and elbows; also often on the trunk and lower extremities. Acnitis is the deeper form and usually affects the face.

The histological structure of Folliclis and Acnitis is practically the same, and the two conditions frequently occur together in the same patient. Most microscopical sections show the ordinary alterations of inflammation, i.e., cell infiltration consisting of numerous round cells and a few plasma cells. Necrosis of this inflammatory focus occurs and the necrotic mass is extruded, after which healing takes place, leaving a round scar which is often surrounded by a zone of pigmentation. In some cases epithelioid and giant cells have been found. The most characteristic feature is the necrosis, which may appear in any portion of the corium down to the subcutis, the surrounding tissue exhibiting a narrow band of epithelioid cells and lymphocytes. The sweat glands are implicated in the infiltration and finally undergo necrosis also.

Primarily/

Primarily the deep veins of the cutis are involved in the process, which begins as an endophlebitis with proliferation of the intima and thrombus formation. Endarteritis has also been described, going on to complete obliteration of the vessel. According to most investigators the occurrence of necrosis is directly due to this occlusion of the arteries and veins.

Cases of the transition of the tuberculids into general miliary tuberculosis of the skin or other forms of lupus vulgaris have been reported on numerous occasions.

Wise and Satenstein(5) are of the opinion that Folliclis and Acnitis are brought about by a haematogenous infection, the bacilli circulating in the blood stream ultimately finding a resting place in the blood vessels of the cutis, where they are destroyed and liberate toxins, which cause the formation of the tuberculid lesions.

The clinical and laboratory data are sufficient to justify the assumption that the papulo necrotic tuberculids, despite their frequent non-tuberculous histological structure, are forms of true tuberculosis of the skin, and are either due to the tubercle bacillus itself, or to its toxins. Wise and Satenstein consider that while Folliclis is always due to the tubercle bacillus/

bacillus, Acnitis, though often due to that organism, is not invariably so.

Cases of the co- existence of lupus miliaris disseminatus faciei and acnitis of the face have been recorded. The chief differences in the two lesions are that in lupus miliaris disseminatus faciei the lesions sometimes show the applejelly colour, when pressed upon with a watch glass, and rarely central necrosis. In Acnitis the applejelly colour is absent, and the lesions show central necrosis. On microscopical examination lupus miliaris disseminatus faciei always presents the structure of a typical tuberculoma, while in acnitis the histological structure is usually that of an ordinary inflammatory reaction, only occasionally the tuberculoid structure being encountered. Also in lupus miliaris disseminatus faciei the tubercle bacillus is found much more frequently than in Acnitis.

II. Bacteriology of Lupus Vulgaris.

The tubercle bacillus is now the accepted cause of lupus vulgaris, the bacillus being in some cases of the human type, and in other cases of the bovine type. As found in the lupoid lesion the bacillus is of a much less virulent character than its usual state. In lupus the tubercle bacilli are seen in extremely scant numbers, and it is possible that the bacilli may undergo rapid destruction, or that the morbid action results from their products or toxins. Sir Malcolm Morris (6) considered that the number of bacilli found varied directly with the acuteness of the case.

In other forms of cutaneous tuberculosis the bacilli are often found in greater abundance, and this is especially so in the more acute lesions such as tuberculosis ulcerosa.

In the Final Report (1911) of the Royal Commission on Tuberculosis (Human and Bovine) it was stated, that of 20 cases of lupus which were investigated, in 9 a bacillus was found presenting the cultural/

tural characteristics of the bovine bacillus, though in only one of the nine did the bacillus exhibit the high virulence of the bacillus of bovine tuberculosis. In two cases it was found possible to increase the virulence up to the high virulence of the bovine tubercle bacillus.

Kirchner(7) investigated 36 cases of lupus and found the tubercle bacillus of the human type in 12 of them. In 13 cases bacteriological examination was negative.

Andersen(8) on examination of 29 cases of lupus vulgaris found the bovine tubercle bacillus in only 3 cases, the human type being found in the remaining 26 cases.

A. S. Griffith(9) records the result of investigating 140 cases, the tubercle bacilli being classified according to their behaviour on culture, and their virulence to experimental animals. Of the 71 showing typical bovine characteristics on culture, 22 were characteristically virulent to all the species of experimental animals tested, Of the 66 showing typical human characteristics on culture, 19 showed standard virulence to experimental animals. There were also 3 cases in which the strains were atipical in cultural characteristics./

characteristics. Griffith concludes that all evidence goes to show that lupus is produced originally by a tubercle bacillus of normal virulence, and that its virulence becomes modified in the course of the disease.

Thus from the above results it will be seen that, with the exception of Andersen's figures, the number of cases in which the bovine type was found was practically the same as the number in which the human type was present.

Culturally and by experimental inoculation into animals the bacillus extracted from lupoid tissue was found to be of considerably diminished virulence.

Mode of Inoculation of the Skin.

1. The tubercle bacilli may gain access by an abrasion or puncture of the skin or mucous membrane - direct inoculation.

2. Secondary infection of the skin from sinuses, etc., resulting from the breaking down of tubercular glands, may occur.

3. The tubercle bacilli may be carried to the skin via/

via the lymphatic system from some distant focus.

4. The bacilli may be carried to the skin by the blood stream from some distant focus.

Possible Determining Factors of Site of Lupus Vulgaris.

Stelwagon (10) considers it very probable that weakened tissues, and regions disposed to circulatory disturbances, show less resistance to invasion by the tubercle bacillus. The flushing parts, such as the cheeks, nose and ears, and dependent situations such as the extremities, where the circulation is sluggish, as well as regions weakened by chillblains, are the most vulnerable areas.

Mode of Spread of Lupus Vulgaris.

The arising of new points or foci beyond the main patch is doubtless due to the bacilli or their products spreading either in the perivascular spaces, or along the lymphatic channels. Sampson Handley, as previously described in detail (page 4), is strongly of the opinion/

opinion that the latter is the mode of spread, and gives strong evidence to support his claim.

III. Description of Ultra-Violet Rays.

It has been found by experiment that ordinary sunlight is composed of a very large number of waves varying greatly in length, These wave lengths are measured in Angstrom Units, one such unit being a ten-millionth of a millimetre. Those wave lengths of the spectrum between slightly less than 8000 A.U. for the longer limit, and 4000 A.U. for the shorter limit, are able to stimulate the eye, and are therefore called the visual rays; and this section of rays is known technically as an octave of light. Rays whose wave lengths fall outside these limits are invisible to the eye, and are called infra- red when they are too long, and ultra-violet when they are too short. The infra-red rays produce the sensation of heat, hence are also called heat rays, while the ultra-violet rays, from their ability to perform certain chemical reactions, and notably those used in photography, are called actinic rays. There is however no sharp line of demarcation between the three groups. In the spectrum the blue changes to violet at 4000 A.U., and the violet portion extends to 3800 A.U., where visibility ceases, the/

the rays of shorter length being the actinic or ultra-violet rays, which are invisible.

In the solar spectrum, in addition to the octave of visible rays, we have about six octaves of infra-red rays, and about half an octave of ultra-violet rays extending to 3000 A.U. In various forms of artificial illumination, of which the spectrum extends much farther towards the ultra-violet direction than that of sunlight, the most extreme ultra-violet rays have been found to extend to as short a length as 360 A.U. Thus the extreme limits of ultra-violet rays are 3800 A.U. to 360 A.U., but only those between 3800 A.U. and 3000 A.U. are present in sunlight.

The rays which are of importance in ultra-violet therapy are those between 3800 A.U. and 2000 A.U.; those of shorter length, not having any bearing on this subject, will not be further considered.

The section 3800 A.U. to 2000 A.U. is further sub-divided into two sub-sections:-

(1) 3800 A.U. to 3000 which are known as the near ultra-violet rays; and,

(2) 3000 A.U. to 2000 known as the far ultra-violet rays.

Hence the solar spectrum contains only the near ultra/

ultra-violet rays. These two subdivisions differ considerably in their chemical actions. The near ultra-violet rays have only comparatively little germicidal action, but considerable penetrative power, while the far ultra-violet rays have much greater germicidal action, but less power of penetration.

The ultra-violet rays were first discovered by Ritter and Woolaston, who showed that in the dark region of the spectrum there were rays capable of blackening silver chloride.

IV. Historical Outline of Ultra-Violet Ray Treatment of Lupus Vulgaris.

In 1893 Finsen first commenced to treat lupus by means of sunlight. He exposed to the sun's rays only that part of the body which was affected, believing that the curative effect was due to the bactericidal power of the rays. Patients were first treated by unmodified sun's rays, and good results have been recorded from this method of treatment. At the Paris Conference on Tuberculosis in 1905, a communication was made on the treatment of lupus vulgaris by unmodified sun's rays by M. Revillet of Cannes, who gave statistics of 11 cases of lupus vulgaris, and 34 cases of scrofuloderma treated by this method, only the lupoid areas being exposed to the full glare of the sun. Of the 11 cases of lupus vulgaris, 8 were cured - i.e.73%, the other 3 remaining stationary. Of the 34 cases of scrofuloderma 28 were cured - i.e. 82%, and the remaining 6 were much improved.

Dr J. G. Tomkinson(11) also describes a case treated by exposure of the affected part to the sun's rays at Helouan/

Helouan with great benefit. The disease had been present for 25 years, and all previous methods of treatment had been unsuccessful.

Finsen next devised an apparatus to concentrate the rays on the affected area. This apparatus consisted of a lens of about twenty centimetres in diameter. The lens was composed of a plane glass and a curved one whichwere framed in a brass ring, and between them there was a bright blue weak ammoniacal solution of copper sulphate to absorb the infra-red rays, and so cool the rays coming through. As one surface of this apparatus was plane and the other curved, its optical function was that of an ordinary plane convex glass lens. The apparatus was mounted on a stand in such a way that it could be placed perpendicularly to the sun's rays, and at such a distance as to make the light focus on the area of skin which it was intended to treat.

However, Finsen soon realised the uncertainty of sunshine each day in Northern Europe, and he next devised an apparatus whose source of illumination was a carbon arc lamp of 50 amperes instead of the sun. The rays of this lamp, which are very rich in the ultra-violet end of the spectrum, were concentrated through/

through a telescope-like apparatus, and focussed on the skin, One portion of the telescope-like apparatus was filled with water to absorb the heat rays, and surrounding this portion was a mantle, through which cold water was kept running to prevent the water in the telescope tube from heating. Finsen had previously found that ordinary glass absorbs most of the ultra-violet rays, so the lenses of his apparatus were made of quartz. It was found that the light from this apparatus was still too warm to be applied to the skin without causing pain, so Finsen next devised an apparatus consisting of a plate of quartz and a plane convex lens of quartz, both framed in a conical brass ring, and through it cold water was continually circulated. This apparatus was kept pressed against the skin of the patient by an elastic bandage, and it had the further advantage of making the skin anaemic, and so allowing a deeper penetration of the actinic rays. With this apparatus an area of about one and a-half centimetres in diameter was treated for an hour each day.

From this initial carbon arc lamp of Finsen all the present day modifications and improvements have been devised.

Carbon/

Carbon Arc Light Baths.

Dr. Axel Reyn was the originator of the general carbon arc light bath. He observed that sometimes at the Finsen Institute at Copenhagen an extensive eruption of lupus not only healed up at the site of the local concentrated light (Finsen) treatment, but also in places which had not received any applications of light. Reyn (12) put this down to the liberation of tuberculin at the site of the local treatment, and to its having been carried to the other lupus patches by the blood stream, and having a beneficial effect on them.

There is ample evidence in the literature to prove the curative action of universal carbon arc light baths. Sequeira(13) at the London Hospital found that with Finsen light he got 70% of permanent cures. The cases which failed to be cured with Finsen light he subjected to carbon arc light baths and cured 20 out of every 30 such cases, thereby increasing his total cures to 90%.

Heiberg and Carl With(14), in statistics of cases treated at the Finsen Institute got 60% permanent cures with Finsen light only, and 90% with Finsen light plus the carbon arc light baths. In the cases presented

at/

at the end of this Thesis I shall show that it is possible to cure lupus vulgaris by carbon arc light baths alone, but Heiberg and Carl With have found that the cure is hastened by the simultaneous local application of Finsen light. This was clearly demonstrated in the case of a patient who had several patches of lupus. He was treated with general arc light baths, and one lupus patch only received Finsen treatment. It was shortly found that this patch improved more quickly than the other patches. (15)

Apparatus/

V. Apparatus

The apparatus from which is produced ultra-violet light for therapeutic purposes consists fundamentally of an arc. This arc is formed by the current passing between two terminals, the result of which is a very brilliant illumination, which is composed of the invisible ultra-violet rays, together with various visible rays. The arc may be of either carbon, tungsten or iron, or a mixture of these and certain other elements, and the following are the lamps in general use for irradiation of a limited portion of the body, the fundamental principles of which are similar in all the lamps.

1. Mercury vapour lamps which may be either
   (a) air-cooled, or
   (b) water-cooled, this latter being known as the "Kromayer" lamp.
2. Carbon arc lamp such as the Finsen, or its modification the Finsen-Reyn lamp.
3. Tungsten arc lamp.

Mercury/

Mercury Vapour Lamp.

In this lamp the arc is formed in a mercury vapour surrounded by a quartz tube, this tube either being without further covering, in which case it is air- cooled; or it may be in a metal case with quartz windows, and circulating through this case is cold water. This latter is the water-cooled or Kromayer lamp.

Carbon Arc Lamp.

The principles of the Finsen lamp have been already described, but there is in use a carbon arc lamp burning in the open air, without any concentrating apparatus, for irradiation of a limited portion of the body.

Tungsten Arc Lamp.

This lamp burns in the open air, and its electrodes are pure rods of tungsten.

All these lamps have metal reflectors behind the arc to increase the intensity of the irradiation.

The mercury vapour and tungsten arcs are very much richer in the far ultra-violet rays (3000 A.U. to 2000 A.U.) than the carbon arc lamp, hence have greater/

greater bactericidal power. In fact a special type of mercury vapour lamp, known as the Cooper-Hewitt lamp, is used to sterilise water.

The carbon arc lamp, on the other hand, is richer than the other two in the near ultra-violet rays (3800 A.U. to 3000 A.U.), and so has greater penetrative power.

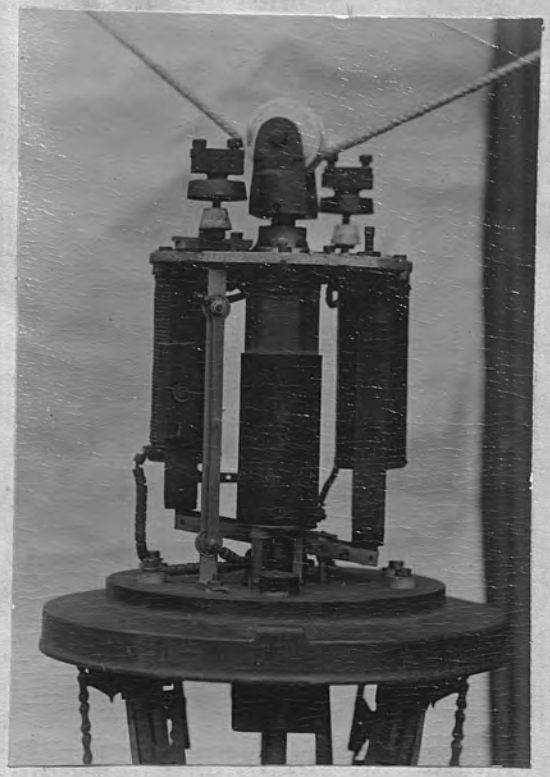
VI. Description of the "Flame" Lamp.

At the Edinburgh Royal Infirmary the apparatus used in the ultra-violet ray therapy of lupus vulgaris consists of five large carbon arc lamps arranged in two groups, one of three lamps and the other of two lamps. The five lamps are all wired up in the same circuit, in connection with which there is on the switch board an ammeter and resistance coil.

The particular type of lamp used is what is known as the "Magazine" or "Flame" lamp, which was constructed for street illumination about 1909. Each lamp is of 3000 candle-power, and has had the glass globe surrounding the carbons removed so as not to cut off the ultra-violet rays. The electrodes consist of a pair of carbons, the positive carbon being five- sixteenths of an inch, and the negative one quarter of an inch.in diameter. The carbon points are in the horizontal axis in relation to each other, and they approximate to make the arc, after which they separate to a distance of about one quarter of an inch apart, when the arc is maintained across the space, producing an intense illumination.

The/

The lamp has an electro- magnetic mechanism for pushing down the carbons gradually as they are burnt up, and there is also an arrangement in the lamp to maintain the current through the five lamp circuit if one lamp fails to burn. The total weight of each lamp is approximately 56 lbs. Below are three photographs of the "Flame" lamp with the outer casing removed to show the mechanism.



Each lamp consumes two amperes, so that the group of three lamps have a total consumption of six amperes, while the group of two lamps together consume four amperes, The voltage in each lamp is about 45 volts, giving a total of 230 volts for the five lamps. The lamps are run on the direct current.

The group of three lamps are arranged in triangular formation, a distance of 12 inches separating the carbons of one lamp from those of its neighbours. The carbons of the two-lamp group are also 12 inches apart the one lamp from the other.

Each lamp is suspended over a pulley by a counter weight, which allows the lamp to be elevated or lowered to any height above the ground. The height of the carbons above the ground in the lamps used in the treatment was 39 inches.

VII. Therapeutics of Ultra-Violet Rays in Lupus Vulgaris.

1. Bactericidal Action.

It has been universally known for countless ages that sunlight has a bactericidal action, hence for many centuries man has exposed to the sun clothes and other objects he wished to cleanse. Also it has been common knowledge for long that disease and death are more frequent in the narrow sunless alleys of great smokey cities than in rural districts. These facts showed long before it was proved scientifically that the sun's rays had a bactericidal action.

This bactericidal action was first demonstrated scientifically in 1877 by Downes and Blunt(16), and it was proved later by Koch in 1890, who found that tubercle bacilli in sputum, spread out in a thin film or on a glass slide, were killed in ten minutes.

Finsen and Bie(17) found that the sun took over an hour to kill bacteria in plate culture in the hottest days of summer in Copenhagen, and so had too slight a bactericidal action to be of much value in therapeutics.

Finsen/

Finsen found that a more energetic action could be obtained by concentrating the light from his electric arc lamp, which he used for treating patients, on bacteria in plate culture; the bacteria were then killed in a few seconds.

Artificial sources of illumination are known to be particularly rich in ultra-violet rays, so it was deduced that these rays are the bactericidal ones. This has been amply confirmed by Downes, Blunt, d'Arsonal, Charron, Finsen, and Bie by experiments in which culture tubes were exposed to different parts of the spectrum, when the ultra-violet rays were found to be the bactericidal ones. This was further verified by another group of experiments in which white light was filtered by making it pass through substances which only permit the passage of certain groups of radiations. In this way it was found that the ultra-violet rays between 3000 A.U. and 2000 A.U. - i.e., the far ultra-violet rays had the most potent bactericidal action.

This was further verified by reducing the range of the solar spectrum at the violet end by about 500 A.U. by a suitable screen, when it was found that the time necessary for sterilisation may be increased from 12 minutes to 3 - 5 hours.

Thus/

Thus the most powerful bactericidal action of this group begins at wave length just under 3000 A.U., that is to say at a wave length which does not exist in the solar spectrum in which the shortest wave length is 3000 A.U., otherwise all bacterial skin diseases would be cured spontaneously in summer.

But the noxious action of light is not only limited to the bacteria, but also affects their products and secretions. Thus tuberculin, which has been exposed to ultra-violet radiation, loses its power to produce intradermic reaction, and toxins of diphtheria and tetanus lose their toxicity when so exposed.(18) The destruction of these products however is difficult, and demands prolonged irradiation of a sufficiently dilute solution - e.g., 5 hours irradiation is necessary before the tuberculous toxin loses the power of provoking a reaction in a guinea-pig.(19) Also a culture of tetanus bacilli which is hardly affected by an hour's irradiation when 1 - 2 millimetres thick, is killed in a few minutes when it is diluted 2000 times in water.

The bactericidal action of ultra-violet rays is more potent in a warm temperature than in a cold one. Hall(20) found that ultra-violet rays kill infusoria at/

at 20 degrees centigrade in one third of the time required at 10 degrees centigrade.

Humphris (21) believes that the ultra-violet rays not only kill bacteria and their toxins, but also assist the development of antibodies.

With regard to the antiseptic property of ultra-violet light, Crocker(22) states that every surface which is bathed in its radiation is rendered aseptic.

This bactericidal action is undoubtedly of very great importance in the cure of lupus vulgaris by ultra-violet therapy.

2. Penetrative Action of Ultra-Violet Rays.

Ultra-violet rays have the power of penetrating the skin, though the depth of penetration is somewhat limited. This penetrative property was proved by the following experiments:-

1. Godneff(23) introduced under the skin of dogs and cats, with a trocar, small sealed tubes containing muriate of silver. The animals were then exposed to direct sunlight, after which the tubes were taken out, and the muriate of silver was found to be blackened, hence/

hence showing that the actinic rays had penetrated the skin.

2. Migneco (24) introduced under the skin of guinea pigs fragments of dried tissue impregnated with tubercle bacilli. He showed that after 24 to 36 hours of irradiation they were no longer capable of infecting a fresh animal.

3. Finsen(24) has shown that the light from a voltaic arc is capable of sterilising a culture in 45 minutes after passing through the ear of a rabbit.

By the following two experiments it has been demonstrated that if the skin is rendered bloodless, the chemical rays can penetrate to a greater depth.

1. Finsen(25) placed a piece of sensitised paper on one side of a man's ear, and let the violet rays of his apparatus for concentrating sunlight fall on the other side of the ear. After five minutes this paper was not affected. On the other hand the paper was distinctly blackened in twenty seconds if all the blood were pressed out of the ear.

2. If one looks into a spectroscope through an ear filled with blood only a red stripe is seen. If the ear be made bloodless all the colours of the spectrum can be seen.

Experiments/

Experiments by Jansen, Maar and Hasselbalck show that the ultra-violet rays are the only rays which have the power of penetrating the epidermis, but this penetrative power is only a limited one, for, as soon as the rays get at the tissues filled with blood, all chemical light will be absorbed by the blood. So if we wish the light to have any effect at a greater depth we must render the skin bloodless by a compressing apparatus such as in the Finsen light apparatus.

Jansen and Delbanco(26) found, after an intensive exposure to Finsen light for two hours, that no histological changes could be observed deeper than 0.7 millimetre from the surface of the skin. Heiberg and Lomholt(27) also investigated the depth of the effect of the Finsen light after one to six hours exposure, and found the result much the same as that of Jansen and Delbanco; no evidence of penetration as shown by histological changes beyond 1.0 millimetre. They also found that a long exposure to the light (6 hours) did not produce a greater depth of reaction than a short exposure.

Professor Russ(28) showed experimentally that the wave lengths ranging from 3000 A.U. to 2000 A.U. are very easily absorbed by vegetable and animal tissues, and/

and have a lesser degree of penetration than those of longer length - i.e., 3800 A.U. to 3000 A.U.

The ultra-violet rays of the spectrum are those most easily absorbed by the atmosphere, hence they are much more absorbed at low altitudes, where the atmosphere is most compact, than at high altitudes where the atmosphere is rarified. Thus patients undergoing heliotherapy at high altitudes, such as Alpine resorts, derive much more benefit from the ultra-violet rays of the sun than those undergoing treatment at lowland places. But on the coast the depreciated ultra-violet rays are considerably augmented by the reflexion of light from the surface of the sea.

The less perpendicular the rays are the greater is the absorption from the atmosphere, because the length of rays passing through the lower and more concentrated regions of the atmosphere increase as the rays fall less and less perpendicularly, and so the chemical force of the sun is much greater in summer, when the sun is perpendicular, than in the winter, when it is low in the horizon.

Russ formed the opinion clinically that it was to the wave length between 3800 A.U. and 3000 A.U., together with the visible region, that we must look for/

for the effective part of the ultra-violet radiations in therapy, and substantiated his claim by the following experiments:-

1. The full radiation from the sun or from artificial sources was beneficial.

2. The radiation filtered of the very short wave lengths, namely those less than 3000 A.U. was still beneficial.

3. The radiation filtered still further, so as to exclude wave lengths shorter than 3800 A.U., was not nearly so beneficial.

Ultra-violet rays are absorbed by ordinary glass, hence sunlight does not exert its actinic action if the patient be behind a closed window, nor does the patient derive any ultra-violet rays from the carbon arc lamp if the carbons are enclosed in a glass covering.

3. Hyperaemia.

If an unaccustomed skin be exposed to the sun's rays or those of a carbon arc lamp, we get, after 5 to 20 minutes, some degree of visible hyperaemia, the intensity/

intensity of which, and the time necessary for its production, are proportional to the susceptibility of the patient.

The actual heat of the sun or lamp is negligible in the production of this hyperaemia, as may be shown by the fact that the rays of the lamp are absolutely cold beyond a certain distance, at which distance they are still capable of producing hyperaemia.

4. Erythema.

A further two or three exposures leads to the production of erythema which is but an exaggerated variety of the hyperaemia. The erythema is due to the dilatation of the skin capillaries, and so the skin gets an improved blood supply with its attendant increased transudation of lymph, etc. This erythema varies from a faint pink flush, which rapidly disappears, to an intense redness, which may last a week or more, and be followed by desquamation. The erythema is comparable to that following an exposure to X-rays, differing only in its latent period and intensity.

It/

It has been known for some considerable time that if light is passed through ordinary glass the ultra-violet rays are absorbed, and using this fact, Widmark, of Stockholm, showed that the erythema was due to the ultra-violet rays. If the light were passed through glass before reaching the patient's skin, no erythema resulted.

Rollier considers that strong erythemata are to be avoided, but Reyn thinks the best results are attainable if a pronounced erythema is produced in the earliest stages of the treatment. I am inclined to agree with Rollier and think it is best to proceed slowly, much in the same manner as in vaccine therapy.

5. Acute Dermatitis.

Sometimes we have the erythema going on to the production of an acute light dermatitis with vesication, followed by desquamation. This occurred in two of my 18 recorded cases, and is well shown in the photo-graph on the next page.

6. Pigmentation.

In the course of two or three weeks' treatment we have the erythema followed by pigmentation of the whole skin surface, the pigment varying in intensity in different subjects. Usually the pigmentation from its commencement is evenly distributed over the skin, but occasionally it first appears in a mottled arrangement, especially over the region of the back, and later, as the pigmentation deepens, the mottled appearance disappears, This mottling occurred in two cases of my series (cases 11 and 12), and the

appearance/

appearance is shown in the accompanying photograph:-

The pigmentation is the result of melanin granules forming round the nuclei of the epidermis and the basal cells, and is Nature's defence against the absorption of too large a quantity of light. When once the skin has pigmented well all over there is no longer any danger of over-exposure. If pigmentation comes on rapidly we can hasten the treatment, while as before mentioned, if marked erythema occurs, caution is necessary.

Russ (28) pointed out that the patients who pigmented readily were those who reacted favourably to the ultra-

ultra-violet treatment. Sequeira(29) also found that as a general rule the more the patient's skin became pigmented, the better are the results of the treatment, and my results quite agreed with this.

In addition to having a protective screen-like action, pigmentation seems to have a transforming action, converting the physical energy of the ultra-violet rays into chemical energy which Sir Henry Gauvain(30) considers can be made use of in the body on the analogy of the chlorophyll pigment of the plant, though this theory has not yet been satisfactorily proved, Rollier(31) considers that the action of the pigmentation is analogous to that of certain fluorescent substances such as eosine and erythrosyne, which can transform short into long wave lengths. It is the long wave lengths which are the more penetrating, and so now the rays can reach the deeper portions of the skin.

However, it seems practically certain that, for the indirect advantages of the ultra-violet ray treatment to be obtained, pigmentation is essential. In general terms, the greater the area pigmented, and the longer the exposure can be comfortably maintained, the greater appear to be the benefits derived. I did not get such a deep degree of pigmentation in my cases as/

as Sequeira evidently got,as the amperage I was using was only six in one treatment room, and four in the other. Sequeira's lamp on the other hand was of 50 amperes, But undoubtedly the degree of pigmentation is proportional to some extent to the amperage of the lamp employed.

Professor Leonard Hill experimented with six children who pigmented well, and six who did not pigment well, all the other conditions as to treatment, food, etc., being equal. Those who pigmented well showed marked increase in weight and basal metabolism, as compared with those who did not pigment well. In fact the basal metabolism was greater than in the healthy normal child of the same age under normal conditions.

The variability in the degree of pigmentation in my cases was undoubtedly due, to some extent, to the more enterprising patients obtaining the seats nearest to the lamps. This error of technique of course is not present in heliotherapy where all the patients have exactly the same intensity of exposure, and so individual idiosyncrasies of pigmentation can then show themselves better.

7. Destruction of Lupus Tissue.

In addition to the bactericidal action previously described, ultra-violet rays, whether administered by sunlight or arc lamp, produce a destruction of the diseased cells of the skin and the granulation tissue, and this is followed by a proliferation of healthy tissue.(32) Owing to the limited power of penetration of the skin by these rays, this necrotic action is confined at first to the superficial portion of a patch of lupus, but this superficial part after necrosis will be thrown off little by little, and a retraction of the surface will take place, so that the light will be able to penetrate more deeply into the skin, and will now reach deeply seated nodules which it could not penetrate to at the commencement of treatment. Thus a recent and superficial patch of lupus will be cured much more quickly than an older and thicker patch, especially if there is much scar tissue present in the latter. This ability of the ultra-violet rays by their direct action, to bring about the histological process of repair, demonstrates that it is possible for carbon arc light baths, without any other treatment, to cure lupus vulgaris.

8. Effect/

8. Effect on Basal Metabolism.

The basal metabolism is increased as a result of ultra violet radiations. This was proved by the previously described experiment of Professor Leonard Hill with children. A great many recent experiments by Bloch, Nageli, Behring, Rothmann and Pinkussen have shown that the blood on which sunlight plays becomes a receptacle of radiant energy. This energy is transported to all parts of the organism, hastening the intracellular processes of oxidation and reduction, and thus increasing the metabolism.(33)

9. General Physical Improvement.

The sun or carbon arc light bath, by dilating the capillaries, brings about an increased flow of blood through the muscular layers towards the skin. By this means the tone of the muscles is greatly improved, leading to general physical improvement.(33) Also the general physical improvement is aided by the stimulating effect of the light on the innumerable nerve-endings in the skin, with a consequent increased tone of the numerous reflex arcs they play on. To borrow/

borrow an expression of Vignard, "the skin becomes a vast keyboard on which light strikes, awakening deep resonances throughout the body."

Through wearing clothes the vasomotor reflexes of the skin become sluggish through disuse, and great susceptibility to heat and cold results. The effect of the ultra-violet radiations is to cause the vasomotor mechanism to recover functional activity sufficiently to enable the patient to be comfortable throughout wide variations of temperature. This thermal property coincides with the development of pigmentation, and is definitely proved by the fact that tubercular children in Switzerland after pigmentation ski, skate, etc., in mid-winter clothed only in a pair of bathing drawers, without feeling the cold.

Associated with the improved physical condition, there is usually an increase in weight. Sequeira (34) records this in his article in the British Journal of Dermatology, and twelve of my eighteen cases showed an increase in weight during treatment, the other six remaining stationary.

10. Blood Changes.

Gauvain(35) found that under sunlight treatment the number of red blood corpuscles and the amount of haemoglobin

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haemoglobin increase, and a leucocytosis often replaces a leucopenia. In addition the calcium content becomes higher, the concentration of inorganic phosphorus has been proved to be increased(36), and Saleeby states that he and numerous observers have found that light markedly raises the blood content of iron. All these blood changes can be obtained by other methods directed towards the improvement of the general health, and so it is quite probable that these blood changes produced by ultra violet radiation are due more to its beneficial action on the general health, than any specific action on the haematopoietic system.

11. Psychical Improvement.

A feeling of wellbeing and cheerfulness as a rule takes place, replacing in many cases apathy and depression of spirits. This psychical improvement is very striking in many patients, especially in those who, having had lupus for a great many years and despairing of ever getting better, now see the disease gradually vanishing, One of the first objective symptoms of this improvement in spirits is the gradually increasing attention patients, especially the female ones, pay to their appearance.

12. Other/

12. Other Therapeutic Effects.

According to Rollier there is an increased excretion of toxic products.

Humphris (36) asserts that the ultra-violet radiations induce the development of antigens.

VIII. Technique of Treatment.

Around each group of lamps is a seat in the form of a square, on which the patients undergoing treatment sit, clothed in only a pair of bathing drawers, and wearing a cardboard shade over the eyes. Twelve patients sit around the group of three lamps, and eight around the group of two lamps, and they expose in turn each aspect of the body and limbs to the lamp, turning partially round at intervals.

It is important that the circle be not too large, as the nearer the patients are to the light the greater the intensity. The intensity of the light varies with the square of the distance, that is to say if a patient be one metre from the carbons he only gets a quarter of the light he would get if the distance were half a metre.

The lamps are on a level with the head of the patient, and the nearest carbons are at a distance of about 16 inches from him. The patients pass the time sewing, knitting, reading, playing cards, or chatting to one another, and quite enjoy the sociability of the treatment.

In ulcerative types of the disease it is better to heal the ulcers with X-ray treatment prior to the administration of the light bath.

If any scabs are present they are removed with starch poultices.

Dosage.

At the commencement of treatment the dorsal and ventral aspects of the patient are each exposed to the light for about an hour, and the light baths are given on alternate days. This is maintained for about/

about a fortnight to test the sensitiveness of the patient. If no painful erythema nor acute dermatitis occurs, the periods of treatment and their frequency are now increased till the maximum exposure of three and a-half hours, five days per week, is attained. If painful erythema occurs we go more slowly. The lengthened periods are maintained for several months until a satisfactory result is obtained.

It has been my experience during breaks in treatment, that after a few months' exposures, if the patient ceases to attend, the improvement goes on progressing, This was very noticeable in Case12 of my series.

IX. Advantages of Light-Bath Treatment.

1. Its administration is painless.

2. It is less expensive and cures more quickly than Finsen treatment. Also a large number can be treated at one lamp.

3. Very good cosmetic results are obtained. The resulting scar is excellent, being invariably soft, pliable, pale in colour, and with no telangiectasis.

4. It is a particularly good method of treatment for extensive lupus. In connection with multiple lupus lesions I found that lesions on the body and limbs usually improved more rapidly than those on the face. This was very noticeable in Cases 4 and 8.

5. Along with Finsen treatment it greatly reduces the duration of treatment of the one method alone (Reyn and Sequeira).

6. No breach of the surface produced.

7. No opening up of lymphatic channels with consequent risk of generalising the tuberculosis.

8. The only treatment the effects of which are generally as well as locally curative. The great advantage of this is obvious in lupus patients with other tubercular lesions, though the tubercular knee-joint/

joint in Case 14 failed to show any improvement under the light bath treatment. However, Gauvain and Rollier have reported remarkably good results in all forms of surgical tuberculosis, and certainly pulmonary phthisis and tubercular glands stand to gain from the improvement in the general condition of the patient.

9. The improvement, once begun, goes on advancing after treatment is stopped (vide Case 12).

10. Other non-tubercular lesions may be benefitted by the treatment. For example Case 7 suffered from severe dyspeptic symptoms before the light bath treatment, and these soon entirely disappeared after treatment commenced.

Other Points.

1. Sequeira got his good results in lupus more quickly than in my recorded cases. He used a much stronger source of illumination and this I am sure was the explanation.

2. One case which has been undergoing light bath treatment for the past year has, unfortunately, recently developed lupus carcimona. She had many years ago a very prolonged course of exposures to X-rays, and/

and this is the most probable cause of the carcimona, though I am unable to say whether the light bath treatment had any deciding influence on the onset of the malignant disease. It was noticed in her case that the erythema was very marked, though the subsequent pigmentation was slight, and this marked erythema of the lupus patch may have had some influence in stimulating the growth of the carcimona.

SUMMARY.

1. The ultra-violet rays, specially those between 3,800 A.U. and 2,000 A.U., are the curative rays in lupus vulgaris.
2. As only some of these rays (3,800 A.U. to 3,000 A.U.) are present in the sun's spectrum while all are present in the carbon arc-light spectrum, the latter is a greater curative agent than the former.
3. The therapeutic effect of universal carbon arc-light baths is partly due to the local action of the ultra-violet rays on the lupus tissue, and partly to the constitutional improvement produced.
4. Universal carbon arc-light baths alone can cure lupus vulgaris, but quicker results have been shown to be produced by a combination of Finsen local light treatment and the universal arc-light baths.
5. In addition to the cure of the lupus, other pathological conditions may be benefited, and the general physical condition of the patient is greatly improved.
6. Marked improvement in the patient's spirits is brought about by the arc-light baths.
7. After the treatment has been stopped the improvement goes on progressing.
8. Universal carbon arc light baths are the only possible means of adequately treating very extensive lupus vulgaris.

X. Notes of Cases.

Case 1.

Mrs. G. Aet. 42.

January 1924.

February 1925.

This patient has suffered from lupus vulgaris for 12 years, At the commencement of the arc-light bath treatment the disease was of the catarrhal variety and involved the nose, chin, and both cheeks extending back/

back almost to the ears. There was much crusting present.

Previous treatment - Mrs. G. had had tuberculin injections weekly for three years. The lupus had been painted at regular intervals with tri-chlor-acetic acid, and her face had been exposed to the rays of the small air-cooled carbon arc lamp.

General Arc-Light Bath Treatment and Progress. - Mrs. G. began treatment on 23.1.24 with an exposure of the whole body to the arc light of about two hours' duration on alternate days. The length of the exposure was gradually lengthened up to 3½ hours, and since 1.4.24 up to 9.3.25 the light baths have been given daily, excepting for absence of about three months during that time.

She is of a dark complexion, and there was only a slight degree of erythema, and the subsequent pigmentation was relatively not deep. The disease has been steadily improving until now very striking improvement is visible in every part of the affected region. All the crusts have disappeared and are replaced by a good soft pliable scar, free from any active disease excepting a few isolated nodules around the periphery.

She/

She feels very much better in every way, and has gained 10 lbs. in weight during the year. She is much more cheerful, is extremely pleased with the treatment, and says she "seems to be in a new world altogether."

Case 2.

Susan D. Aet. 16.

December 1924. February 1925.

This girl has had lupus vulgaris on the left aspect of the back of the neck for five years, which, prior/

prior to arc light bath treatment, had been treated with tri-chlor-acetic acid applications.

General Arc-Light Bath Treatment and Progress.- Susan has had daily exposures of about three hours' duration from 1.11.24 to 9.3.25, with a fortnight off at Christmas. She is of a fair complexion, and exhibited only slight erythema, but pigmented fairly deeply.

The lupus has very much improved, there being no active nodules present now, and the centre of the patch consists of a good, pliable, almost imperceptible scar.

She states she feels much better physically, and has put on four pounds in weight during the four months' treatment.

Case 3./

Case 3.

Rachel W. Aet. 22.

January 1924. February 1925.

This patient has suffered from lupus vulgaris for 17 years. At the commencement of the arc-light bath treatment it affected the chin, nose, and lower portion of both cheeks.

Previous Treatment. - She has had a considerable amount of X-raying, has had tuberculin injections weekly for five years, has had the affected areas painted with tri-/

tri-chlor-acetic acid, and has also had them scraped and uranium nitrate applied.

General Arc-Light Bath Treatment, and Progress.- Rachael has had daily exposures of about 3½ hours' duration from 7.2.24 to 9.3.25 continuously except for about six weeks' absence. She is of a dark complexion, had marked erythema followed by scaling, and she pigmented deeply. She has made steady progress, and the lesion is very much better everywhere. There are no tubercle nodules to be seen now, and the scar is good on the whole though there is some cheloid and telangiectasis present from her previous X-ray treatment. The lower lip is not quite so much swollen as at the commencement of treatment.

She states she feels much better in every way, and that her appetite has improved. She gained six pounds in weight in the first four months of treatment, and has maintained this increase.

Case 4./

Case 4.

Thomas P. Aet. 30.

January 1924.

December 1924.

This patient has suffered from lupus vulgaris for 24 years. A year ago the parts affected were the chin, both cheeks, left temporal region, and posterior aspect of left calf.

Previous Treatment.- He has had the following treatment - freezing with Co_2 snow, X-rays, tuberculin injections for five years, thyroid extract internally, and/

and the lupus patch painted with liquid acid nitrate of mercury, chloride of antimony, and hydrochloric acid.

General Arc-Light Bath Treatment, and Progress.- This patient has had regular daily exposures of 3½ hours from 23.1.24 to 9.3.25, with about two months' absence in that time. He is of a dark complexion, had considerable erythema, but did not pigment deeply. The face has improved very considerably, and there are now no active nodules, but a very good soft pliable scar is present. The leg has shown even more improvement than the face.

Case 5./

Case 5.

Maggie W. Aet. 18.

January 1924.

December 1924.

This patient has suffered from lupus vulgaris for nine years. When the arc-light bath treatment began the disease affected the right cheek, both sides of the neck down to the clavicle, and round the right side of the neck to the middle line posteriorly. There was a good deal of cheloid in the neck. There was also/

also a patch the size of a five shilling piece on the inner aspect of the left thigh.

Previous Treatment.- She had had the following treatment during the past few years prior to the arc-light baths - scraping, X-rays, tuberculin injections, and the lupus areas painted with pure carbolic acid, tri-chlor-acetic acid, and liquid acid nitrate of mercury.

General Arc-Light Bath Treatment, and Progress.- The patient began treatment on 23.1.24 which has continued daily with 3½-hour exposures to 9.3.25, with six weeks' absence during that time.

She is of a dark complexion, and the erythema was slight in degree, followed by slight scaling. She pigmented deeply however, the back becoming quite bronzed. The condition has improved very considerably, and there are no active nodules present now. The patch on the left thigh is also quite better. The scar contains a good deal of cheloid and some telangiectasis from her previous X-ray treatment. She has gained six pounds in weight.

Case 6/

Case 6.

Mrs. M. Aet. 48.

December 1924.

February 1925.

This patient has suffered from lupus vulgaris for 24 years. The parts affected now are both cheeks, nose, and both ears. She was previously treated with tuberculin injections.

General Arc-Light Bath Treatment, and Progress.- Mrs. M. has had treatment of 3½ hours each day from 21.11.24 to 9.3.25, with a break of a fortnight off at Christmas./

Christmas. She is of a fair complexion, had marked erythema with subsequent peeling, but became only moderately pigmented. The condition has shown marked improvement all over. Practically all the scales have gone, and a good soft scar is being formed. There are still two nodules present on the left cheek, and one or two on the nose, but none on the right cheek. Patient has gained four pounds in weight in three months, and feels very much better in every way.

Case 7.

Lizzie McA. Aet. 24.

December 1924.

February 1925.

This patient has suffered from lupus vulgaris for four years. The sites of the disease are both sides of the neck and under the chin.

General Arc-Light Bath Treatment, and Progress.- She has had daily exposures of 3½ hours from 8.12.24 to 9.3.25, with a fortnight off at Christmas. The lupus shows marked improvement, the ulcerated areas having/

having healed over with commencement of scar tissue formation. This patient had severe dyspeptic symptoms before treatment began, but these have disappeared now. She feels better in every way, and her spirits have improved greatly.

She is of a dark complexion, and had marked erythema, the skin becoming painful on the second day of treatment, and peeling began on the third day. The pigmentation became noticeable after a fortnight's exposure, and she became relatively deeply pigmented.

Case 8.

Mary H. Aet. 15.

December 1924.

February 1925.

December 1924. February 1925.

This patient has had lupus vulgaris since the age of three. The areas affected now are practically the whole of the face excepting the forehead, and it extends behind both ears. The whole of the right buttock and part of the left are involved, and there is also a large patch in the right popliteal space.

Previous Treatment.- She has been previously treated with X-rays, tuberculin injections, and the lupus patch painted with tri-chlor-acetic acid.

General Arc-Light Bath Treatment, and Progress.- Treatment/

Treatment began on 17.11.24, and the patient has had a daily exposure of about 3½ hours' duration since then up to 9.3.25. There was a break of a fortnight at Christmas. She is of a fair complexion, had marked erythema, but only slight pigmentation. The face shows noticeable improvement, but the buttock and popliteal space show much greater improvement, all the crusts, etc., having disappeared, and there is considerable formation of good soft scar tissue in these areas. This case coincides with Case 4 in the fact that the lesions on the body or limbs improved more rapidly than that on the face.

Case 9./

Case 9.

Mrs. K. Aet. 48.

September 1924.

February 1925.

This patient has had lupus vulgaris for 28 years. Both cheeks, the nose, upper lip and chin are affected. She had been previously treated with X-rays over a period of five years, and painting with pure carbolic acid, and tri-chlor-acetic acid.

General Arc-Light Bath Treatment, and Progress.- Mrs. K. is of a fair complexion and had marked erythema followed/

followed by blistering. The degree of pigmentation was fairly deep. There has been considerable and rapid improvement in this case, especially of the left cheek and nose, where no active nodules are now to be found. The right cheek is also much improved, though there is present a considerable amount of telangiectasis as a result of her previous X-ray treatment. There are no active nodules present now on the right cheek. The patient is very pleased with her improvement, and feels better in every way, and much brighter.

Case 10./

Case 10.

Dorothy B. Aet. 24.

January 1924.

December 1924.

This patient has had lupus vulgaris for 17 years. The areas affected now are the neck, and most of the face.

Previous Treatment. - She commenced treatment at the Edinburgh Royal Infirmary in 1911, and since then she has had nearly every method of treatment invented for lupus, these including tuberculin injections weekly for/

for 11 years, X-rays, Finsen-Reyn lamp, Kromayer lamp, carbon dioxide snow, radium, application of uranium paste, and painting with tri-chlor-acetic acid and liquid acid nitrate of mercury.

General Arc-Light Bath Treatment, and Progress.- Treatment began on 25.1.24 with an exposure on alternate days of two hours. From 5.2.24 to 9.3.25 she has had daily exposures of 3½ hours, with about six weeks' absence altogether.

The patient is of a dark complexion, and had marked erythema followed by peeling. There was only moderate pigmentation. All the diseased areas are now well healed and covered with a good soft pliable scar with no telangiectasis. There are still a few isolated tubercle nodules present in the right cheek which are being painted with tri-chlor-acetic acid. This patient gained five pounds in weight during the first six months of treatment. She is still having a weekly injection of tuberculin.

Case 11.

Mary H. Aet. 37.

January 1924.

December 1924.

January 1924. December 1924.

This patient has lupus vulgaris affecting the right cheek and nose. The disease first began four years ago, and prior to the light baths she had been treated with tuberculin injections, and painting and burring of the nodules with tri-chlor-acetic acid.

General Arc-Light Bath Treatment, and Progress.- Treatment was begun on 31.1.24 and was carried out on alternate days for a fortnight, after which she had daily treatment till discharged cured on 5.11.24.

She is of a fair complexion and had not much erythema/

erythema, but pigmented deeply, The pigmentation on the back in her case presented the mottled appearance seen in a few of the patients. The lupus improved steadily, and at date of discharge, 5.11.24, she showed great improvement, all the lupus tissue beihg replaced by an excellent scar. The improvement in this case was very striking, and the patient stated that her friends and relatives had remarked on it. She gained three pounds in weight during the period of treatment, and felt much better physically, but the improvement in her spirits was remarkable, changing from great depression to quite a cheerful disposition. This patient was seen again recently and no evidence of any active disease was found,- in fact the lupus area looked better than when treatment ceased in November.

Case 12./

Case 12.

Christina W. Aet. 35.

January 1924. February 1925.

This patient had lupus vulgaris affecting the right cheek, nose, neck and right ear. The disease began 29 years ago. During the past few years it has been treated with X-rays, Finsen-Reyn lamp, and local painting with tri-chlor-acetic acid.

General Arc-Light Bath Treatment, and Progress. - She/

She had daily exposures of 3½ hours from 21.1.24 to 31.7.24. She is of a fair complexion, and had marked erythema, and this was followed by relatively deep pigmentation. The pigmentation on the back was mottled in arrangement, and was irregularly distributed.

Treatment was stopped on 31.7.24 and the condition then showed considerable improvement, there being no nodules present at that date. Since then the patient has attended the Royal Infirmary once a week for local light treatment of the face with the small carbon arc-lamp, and small areas in turn have been painted with tri-chlor-acetic acid. The improvement so well initiated with the light bath has been steadily continuing. The lupus area on the right cheek consists now of a very good scar. She gained five pounds in weight during her six months' treatment.

Case 13./

Case 13.

Joseph O'F. Aet. 25.

January 1924.

December 1924.

This patient has had lupus vulgaris for 18 years. The whole of the face except the upper half of the forehead was affected, and there was a moderate sized patch over the right lumbar region. He had a strongly positive Wassermann reaction, the condition being a combination of lupus and syphilis.

Previous/

Previous Treatment.- Joseph has had X-rays, tuberculin injections weekly for six years, local painting with tri-chlor-acetic acid, liquid acid nitrate of mercury and chloride of antimony, and local light treatment with the small carbon arc-lamp. He has had also two courses each of six injections of N.A.B., one course in 1921, and the other in 1923.

General Arc-Light Bath Treatment, and Progress.- He has had daily exposures of 3½ hours from 21.1.24 to 9.3.25 with breaks of a few weeks.

He is of a fair complexion, had only slight erythema, and became moderately pigmented. The condition has very much improved, there being no active disease present now. The scar is quite good and pliable. The patch over the lumber region is quite better now, and is covered with a good soft scar. He states his general condition is much better, and his outlook on life more cheerful.

Case 14.

Mrs. S. Aet. 37.

January 1924.

June 1924.

This patient had lupus vulgaris of both cheeks and under the chin. It first commenced nineteen years ago. In addition she had tubercular disease of the right knee joint.

Previous Treatment.- She had, prior to the light bath/

bath treatment, a considerable amount of X-rays, lupus scraped and uranium nitrate powder applied, application of potassium permanganate powder, and painting with pure carbolic acid and tri-chlor-acetic acid.

General Arc-Light Bath Treatment, and Progress.- Treatment began on 22.2.24 and continued daily with the usual length of exposure till 16.7.24, after which date she got married and ceased to attend.

She was of a dark complexion, had marked erythema followed by peeling, and she pigmented deeply. The lupus showed considerable improvement as a result of the five months' treatment, and the patient gained five pounds in weight. The knee condition however did not appear to benefit at all from the light baths.

Case 15./

Case 15.

Mrs. R. Aet. 49.

January 1924. December 1924.

This patient suffered from lupus vulgaris, catarrhal in type, of the whole of the central portion of the face. The disease began 33 years ago.

Previous Treatment.- Prior to the light baths she had had a good deal of X-rays, tuberculin injections for five years, the lupus scraped twice and uranium nitrate/

nitrate applied, and frequent applications of liquid acid nitrate of mercury and tri-chlor-acetic acid.

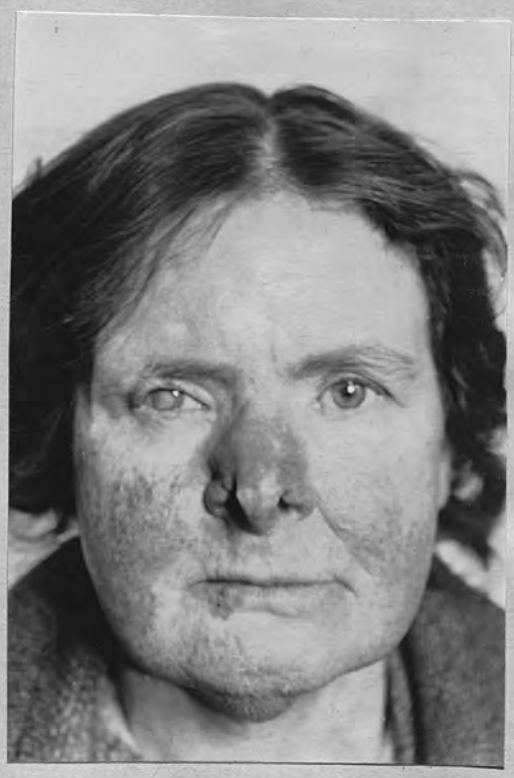
General Arc-Light Bath Treatment, and Progress.- She was treated from 23.1.24 to 12.2.25 on alternate days, but during this time her attendance was rather irregular, including an absence of four months. She is of a dark complexion, and took on only a slight erythema, during which phase her back became covered with small watery blisters resembling a sweat rash. She did not pigment deeply. The lupus showed a good deal of improvement, a considerable amount of it being replaced by scar tissue. She has gained eight pounds in weight during the year.

Case 16./

Case 16.

Mrs. I. Aet. 53.

January 1924.



December 1924.

This patient suffered from lupus vulgaris of the whole of the face except the upper portion of the forehead. The under surface of the chin was also affected. The disease began 17 years ago, and was treated, prior to the light baths, by tuberculin injections/

injections weekly for six years, X-rays, and local application of liquid acid nitrate of mercury and tri-chlor-acetic acid.

General Arc-Light Bath Treatment, and Progress.- The arc-light baths began on 23.1.24 and were carried out on alternate days for ten days, after which, until 9.3.25, they took place daily. The usual exposure of 3½ hours was given.

This patient is fair in complexion and had very marked erythema, her back after four weeks' treatment being intensely red, almost purplish. This was followed by gradual pigmentation, which became quite deep in degree. Since the light bath treatment began, she has shown steady improvement and there are no nodules present now. Her nose, which was ulcerated at either nostril, has quite healed up.

Case 17.

Isa T. Aet. 26.

January 1924. December 1924.

This patient suffered from lupus vulgaris of the right side of the face, nose, and under the chin. The disease began 18 years ago.

Previous Treatment.- She had had a very extensive variety of treatment during the past few years until the/

the light bath treatment was begun a year ago. Her previous treatment included scraping, salicylic and creosote plaster, X-rays, radium, tuberculin injections for several years, uranium oxide ointment, antimonium sulphuratum ointment, pyrogallic ointment, and painting with tri-chlor-acetic acid and liquid acid nitrate of mercury.

General Arc-Light Bath Treatment, and Progress.- This patient has had regular daily exposures of 3½ hours from 26.1.24 to 9.3.25 with about eleven weeks' absence during that period, when she was operated upon for ectropion. She is of a dark complexion, and had marked erythema, the back becoming very red and subsequently blistering. This was followed by marked pigmentation. The lupus has shown very considerable improvement, especially over the nose and cheek, where a good soft scar is now present. There are still a few nodules present under the chin. This patient has improved very much in general health and has gained ten pounds in weight during the year.

Case 18.

Gladys D. Aet. 13.

September 1924. March 1925.

This girl has had lupus vulgaris for three years, and the upper lip, nose, hard palate, and tongue were affected. Prior to the light baths she was treated with X-rays, and lactic acid applications to the palate/

palate and tongue.

General Arc-Light Treatment, and Progress.-

Treatment was begun on 4.7.24 and was carried out daily till 9.3.25 with the usual exposure of 3½ hours. She is of dark complexion, and had marked erythema followed by peeling. The degree of pigmentation was moderate. The disease, both on the skin and mucous membranes, has shown very marked improvement, and the nose and upper lip are now healed over with a good soft scar. No nodules are now present on the lip or nose. Her physical condition has also shown much improvement, and she has gained seven pounds in weight in the last six months. This case showed as rapid improvement as any in the series.

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